Maritime Heritage Minnesota

Ann Merriman
Christopher Olson

Lake Waconia Nautical Archaeology I Project



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Acknowledgments

Maritime Heritage Minnesota thanks the People of Minnesota for their support of the Minnesota Historical and Cultural Heritage Grant program, part of the Clean Water, Land and Legacy Amendment; without the MHCH Grant MHM received to do this project, the work could not have been completed. MHM would also like to acknowledge the Grants Office Staff at the Minnesota Historical Society for their assistance. MHM also thanks Paul and Joyce Melchert for the use of their pontoon boat for our fieldwork. The fieldwork was completed with the help and skill of divers Josh Knutson and Ed Nelson, and the boat handling skills of Mike Kramer. Lastly, MHM thanks our Board Members Deb Handschin and Steven R. Hack for their efforts and a thanks goes to MHM Chair Michael F. Kramer for his in-kind donations to this project.

Cover: MHM volunteers Ed Nelson and Josh Knutson, along with MHM staff Christopher Olson, preparing to dive on Anomaly 27 in Lake Waconia.

CLEAN WATER LAND & LEGACY AMENDMENT

MINNESOTA HISTORICAL & CULTURAL HERITAGE GRANTS

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Introduction

Maritime Heritage Minnesota (MHM) conducted a side and down-imaging sonar survey of Lake Waconia in August 2012 as part of the White Bear Lake and Lake Waconia Survey (WBLLWS) Project. Prior to this survey, no nautical or maritime archaeological sites had been identified in Lake Waconia. MHM noted 46 anomalies during the Lake Waconia Survey (LWS) that appeared to be human-made objects that warranted further investigation. This report presents the findings of the Lake Waconia Nautical Archaeology 1 (LWNA-1) Project that examined, by SCUBA reconnaissance, ten of these anomalies.

A map of Lake Waconia when it was first surveyed in 1872, comprised of two pieces, spanning across two townships (Original Land Survey Maps of Minnesota Collection 1872).





MHM Chair Mike Kramer operated the pontoon boat for part of the project that served as the dive platform

Research Design

The purpose of the LWNA-1 Project was to determine the nature of specific anomalies located during a sonar survey of the entire lake. MHM used sonar data collected during the LWS Project, conducted in August 2012, to identify potential nautical (watercraft) and underwater (other types of cultural remains) archaeological sites located on the bottom of the lake. MHM prioritized which anomalies recorded during the LWS Project deserved priority attention for further research in Lake Waconia. MHM determined the list from an analysis of anomalies that were deemed the most significant based on their acoustical signature. The investigated anomalies were numbers 18-25, 27 and 29 using SCUBA line searches in late September 2013. Further, MHM recorded new sonar data of all the anomalies to augment footage from 2012 in order to answer questions that arose during the SCUBA reconnaissance. During that process, MHM also recorded 'new' anomalies that were not present during the 2012 project to be used for comparative purposes.

Methodology

The methodology used to identify and rudimentarily document underwater archaeological anomalies is straightforward but logistically complicated. MHM used the GPS coordinates of an anomaly (data produced during the LWS Project) to drop a weighted diver-down buoy near the target. The dive boat anchored a safe distance away from the buoy and divers then geared up for the dive. At any given time, there were between two or three divers (MHM staff and volunteers) underwater and a search for each target was conducted. This exploration consisted of 'line searches' where one diver held onto the end of a guideline while a second diver visually searched for the anomalies in concentric circles, increasing the distance away from the pivot point after each circle was completed; in three instances a third diver trailed the searcher visually covering extra terrain. The MHM staff had never dove in Lake Waconia and it was discovered visibility in this lake is consistently poor (usually 1-3 feet) and near the lake bottom it is near zero. Therefore, the line search circles began a short distance from the pivot point and as they increased, the distances were not increased by large amounts in order to identify the anomalies if they existed.

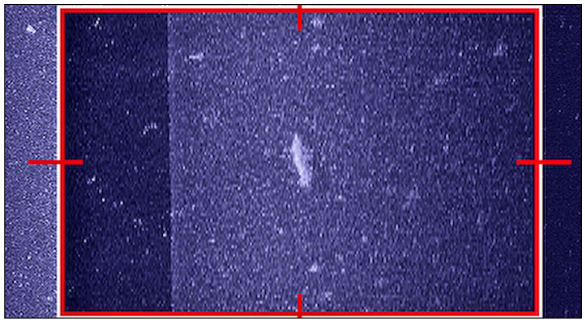
Results of the Lake Waconia Nautical Archaeology 1 Project

After ten dives and line searches, MHM and the volunteers confirmed that each of the anomalies focused on during this project were false sonar targets. One confusing aspect of these disappointing results is the similarity of certain sonar images with those recorded in Lake Minnetonka that were confirmed as wreck sites during MHM's Lake Minnetonka Nautical Archaeology 1 and 2 Projects (LMNA-1, LMNA-2, October 2012-present). Additionally, after diving on anomalies in Lake Minnetonka during May-July 2013 for the LMNA-1 Project, MHM re-prioritized certain Lake Waconia anomalies based on whether they cast an acoustical shadow, had defined edges, and had some form of recognizable shape. Therefore, the negative results of the diving portion of the LWNA-1 Project were frustrating, and prompted MHM to re-scan the area of the lake where all of the anomalies were recorded in an attempt to explain these outcomes. This new side and down imaging sonar recording showed that none of Anomalies 18-25, 27, and 29 existed in 2013, just as the reconnaissance dives indicated. Further, the review

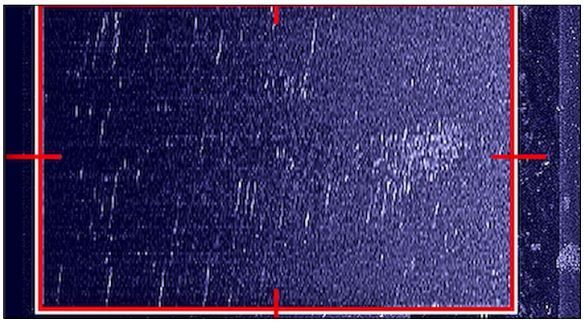
of the new footage included new anomalies not seen in 2012. The 'disappearance' of anomalies from 2012 and the 'appearance' of new anomalies in 2013 required explanations. In order to produce positive – and useful – results from the LWNA-1 Project, MHM determined that comparisons of the sonar images from 2012 and 2013 would be helpful to answer questions about the lack of submerged cultural resources found on the bottom of the lake. Further, the resulting conclusions would be helpful during the analysis of sonar footage from other Minnesota lakes with similar conditions to Lake Waconia in order to plan future dive reconnaissance projects. The ten anomalies investigated during the LWNA-1 Project are analyzed below, listed from the highest priority to the least priority.

1. Anomaly 27

Anomaly 27 was MHM's best evidence for locating a wreck on the bottom of Lake Waconia and was the number 1 priority when diving on the 46 anomalies identified during the LWS Project. MHM estimated this anomaly to be 19 feet long and its 'boat-shape' and acoustical shadow held promise that it was a submerged cultural resource. However, an extensive search of the target area that was 35 feet deep revealed no wreck or other object in the area. The embedded metadata incorporated into the sonar footage allows for the comparison of the 2012 sonar image of Anomaly 27 – and the other anomalies investigated – with images of the lake bottom at their exact locations in 2013. Reexamination by sonar of the lake bottom in 2013 where Anomaly 27 was intially recorded in 2012 confirmed that no submerged cultural resource existed in that location. However, a cloudy area in the 2013 image and in the down image revealed a school of fish in the water column at the time of recording.

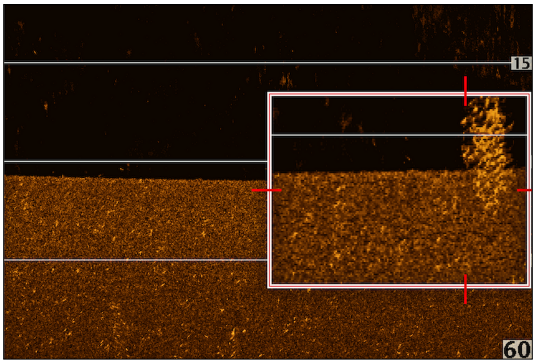


Anomaly 27, recorded in August 2012, strongly suggested a watercraft wreck.



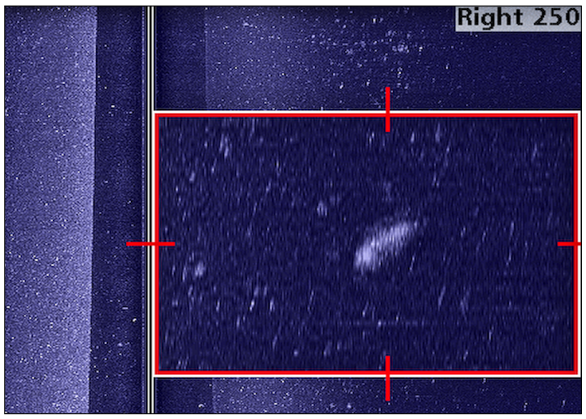
The area where Anomaly 27 would be, recorded in October 2013, where the target would be it if existed. The cloudy area on the right side of the scan is shown in the down image below.

This 2013 sonar down image of the location where Anomaly 27 was recorded in 2012 shows a school of fish in the water column. This natural anomaly correlates to the cloudy area in the sonar side image.

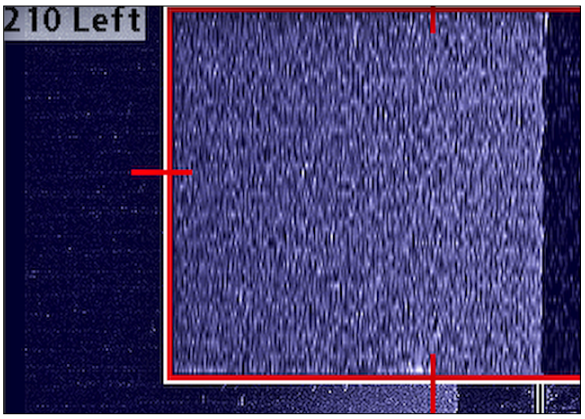


2. Anomaly 29

Originally MHM placed Anomaly 29 ninth in line for significance during the LWS Project. It was estimated to be 10 feet long and was described as a 'boat-shaped feature'. The small amount of acoustical shadow seen in the recorded image of Anomaly 29 suggested it might be a cultural resource. For the LWNA-1 Project, this anomaly was the second one investigated and found to be a false sonar target. The 2013 re-scan of the lake bottom clearly shows the absence of the anomaly. The area where MHM recorded the sonar image is 31 feet deep.



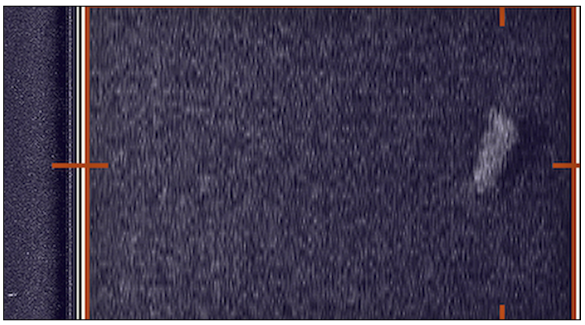
In August 202 Anomaly 29 had a definite boat shape.



The same area in October 2013 clearly shows that no anomaly exists there.

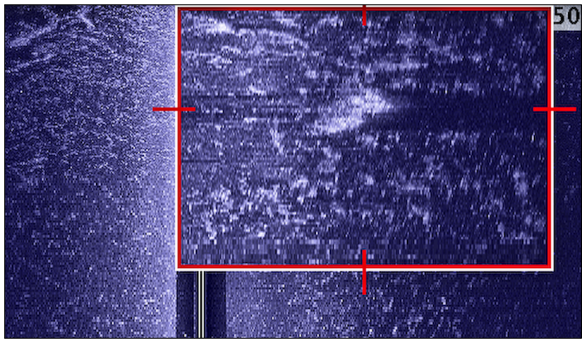
For comparison, during MHM's LMNA-1 Project a similar sonar signature was recorded in Lake Minnetonka. MHM dove on Anomaly 24.1 and it was discovered to be a rock.

This side scan sonar image is Anomaly 24.1 from Lake Minnetonka, recorded in September 2011. MHM dove on this anomaly in October 2013 and the only object found in the area was a rock.

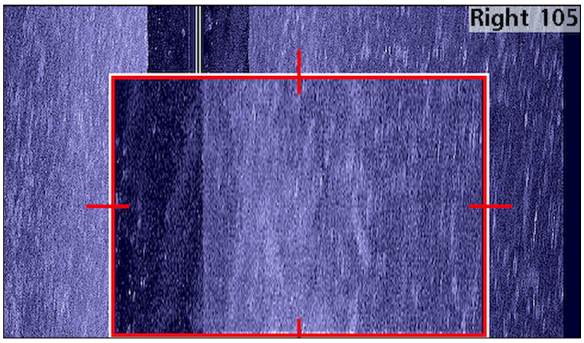


3 and 4. Anomalies 24 and 23

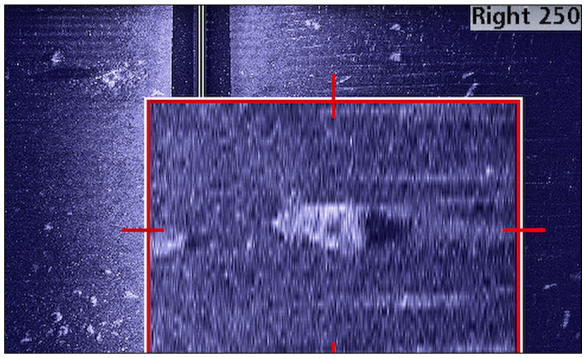
Anomalies 24 and 23 have similar acoustical signatures and during the LWS Project, MHM suggest they may be small and medium-sized watercraft wrecks of 32 feet and13 feet respectively. MHM placed the sigificance of Anomaly 24 as 29th in importance of the 46 recognized anomalies, while number 23 was rated 8th. Reexamination of the lake bottom in 2013 where these anomalies were intially recorded in 2012 revealed no positive sonar returns existed in these locations. The area where Anomaly 24 was recorded was in 15 feet of water while the location of Anomaly 23 was 20 feet deep.



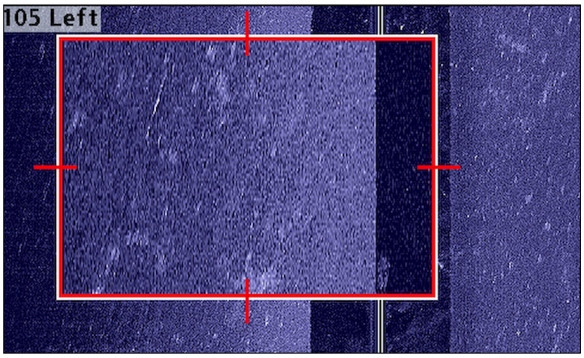
The August 2012 sonar image of Anomaly 24 was strongly suggestive of a sunken watercraft. It's acoustical shadow was substantial.



Unfortunately the September 2013 image of the area where Anomaly 24 was recorded the previous year was clear of objects.



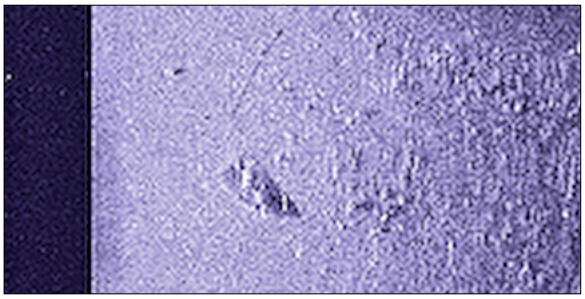
Anomaly 23, in August 2012, greatly resembled a wreck in this sonar recording.



In September 2013, no anomalies were recorded in the same location.

Anomalies 24 and 23 have similar sonar signatures to Anomaly 69 from Lake Minnetonka, a recognized cultural resource. Anomaly 69 is the Lund Aluminum Fishing Boat Wreck whose sonar image is also similar to Anomaly 20.

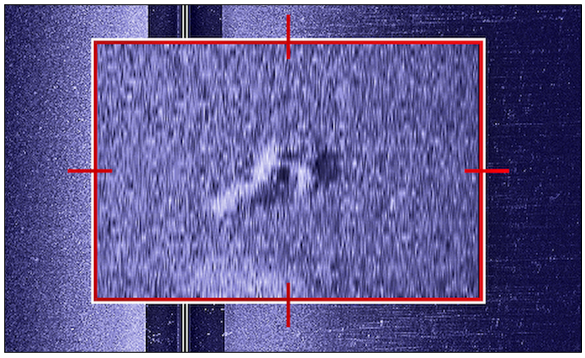
Anomaly 69 is the Lund Aluminum Fishing Boat Wreck located in Lake Minnetonka. This sonar image was recorded in September 2011 and MHM dove on the site in June 2013. This image of the wreck prompted MHM to re-prioritize the investigation of Anomalies 24 and 23, moving them up the list in importance. A photograph of the Lund Wreck can be found below, associated with Anomaly 20.



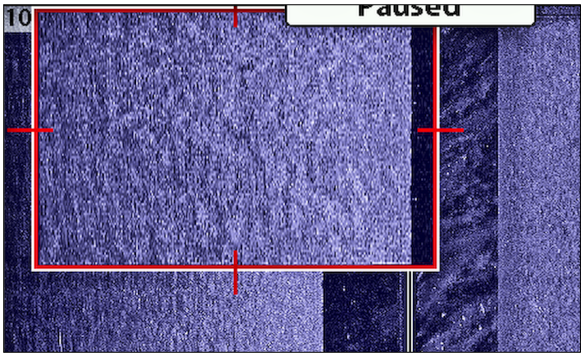
5. Anomaly 18

During the LWS Project, Anomaly 18 was estimated to be 17 feet long, in 23 feet of water, and MHM surmised it might have been a sunken boat that broke up during the wrecking process. The substantial acoustical signature, the shadow cast by the anomaly, and the somewhat defined shape that suggested the anomaly might be a wreck with a cockpit or at least one deck beam, left MHM confident that Anomaly 18 was a submerged cultural resource. The two images clearly show that there is no cultural or natural resource there in 2013. The water is 25 feet deep in this area. During

the LWS Project MHM prioritized Anomaly 18 as number 14 out of 46 anomalies identified during the sonar survey as being possible human-made objects.

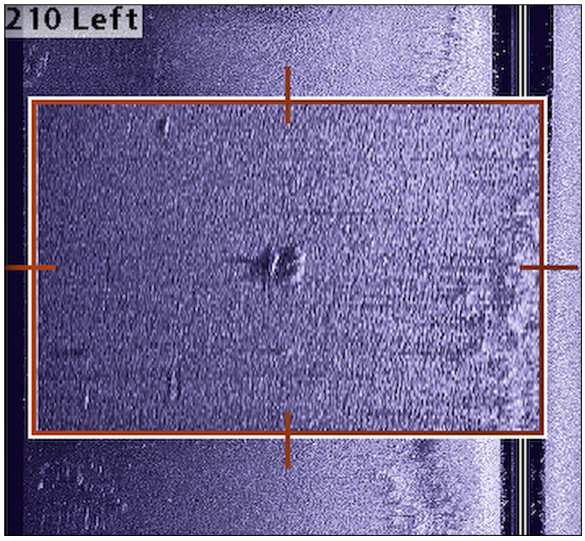


In August 2012 Anomaly 18 had a defined shape.

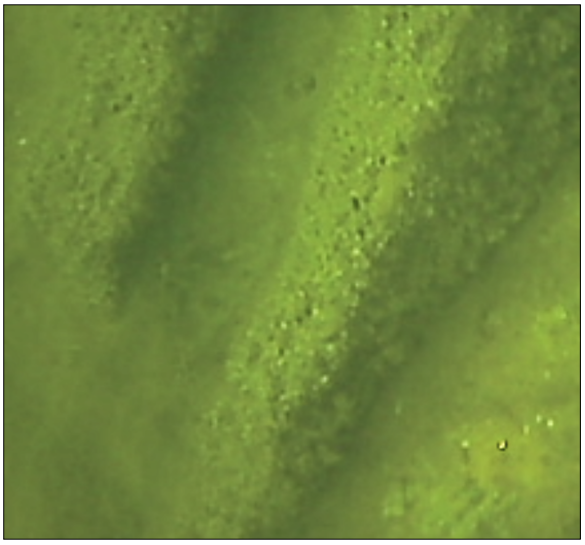


In September 2013 the anomaly is completely absent.

The signature of Anomaly 18 does compare to a known natural resource, Anomaly 25, recorded during the LMS-1 Project in September 2011 and investigated during the LMNA-2 Project in October 2013. Lake Minnetonka's Anomaly 25 has been identified as a cluster of large rocks associated with a piece of wood, possibly part of a tree. While not a submerged cultural resource, Anomaly 25 proved to be a substantial target that cast a significant shadow as part of its signature like Anomaly 18, and is similar in shape.



Anomaly 25 from Lake Minnetonka has a similar acousitical signature to Lake Waconia's Anomaly 18.

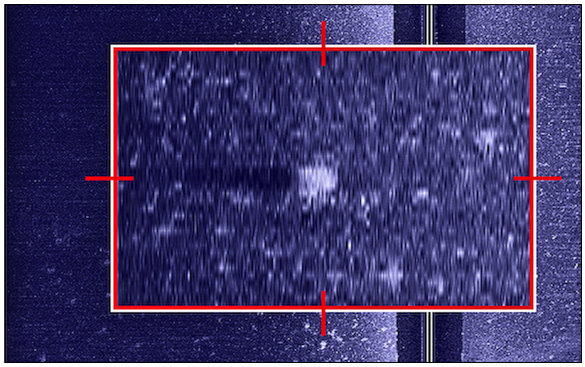


Anomaly 25 is a group of large rocks that could not be captured in the same photograph frame, but a sample is above.

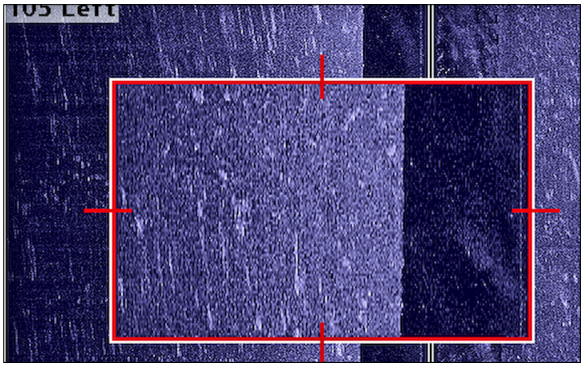
6. Anomaly 19

Anomaly 19 was initially placed 41 out of 46 in importance for diving reconnaissance in analysis of data collected during the LWS Project simply because of its somewhat undefined shape. Anomaly 19 did cast a significant shadow, indicating it stood off the bottom, and was initially believed to be in 22 feet of water. During MHM's re-prioritization of the Lake Waconia anomalies, Anomaly 19 moved to number 6 out of 10

in importance. The embedded metadata incorporated into the sonar footage indicates that the 2013 image of Anomaly 19 contains no cultural or natural resource when compared to the 2012 recording. The water is 18 feet deep in this area. The signature of Anomaly 19 does compare to a known cultural resource, Anomaly 61, recorded during the LMS-1 Project in September 2011 and investigated during the LMNA-2 Project in September 2013.

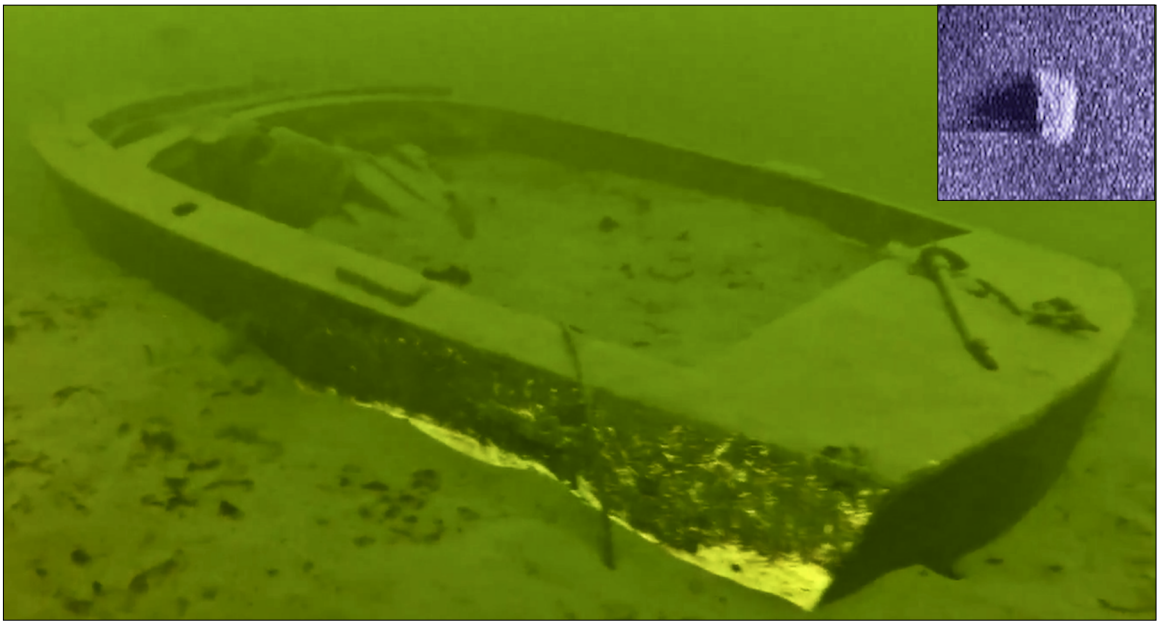


Anomaly 19 in August 2012.



Anomaly 19 should be in this area in September 2013.

Lake Minnetonka's Anomaly 61 has been identified as an early 1950s Correct Craft Runabout, 17.33 feet long and 5.85 feet in the beam. Anomaly 61's shape is slightly more defined than Anomaly 19, but the shape is comparable and 19 casts a more substantial acoustical shadow, but turned out to be a natural resource.

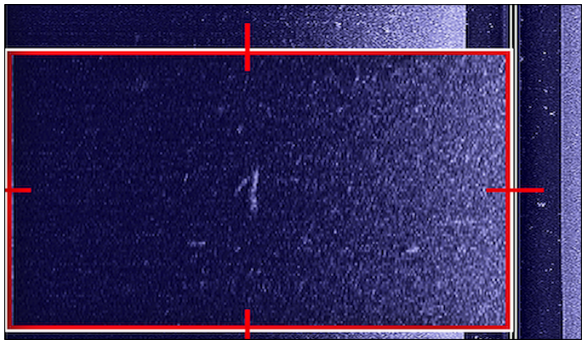


The sonar image in the upper right corner was recorded by MHM in September 2011 and the Correct Craft Wreck site was confirmed in September 2013 (photograph by MHM volunteer Kelly Nehowig).

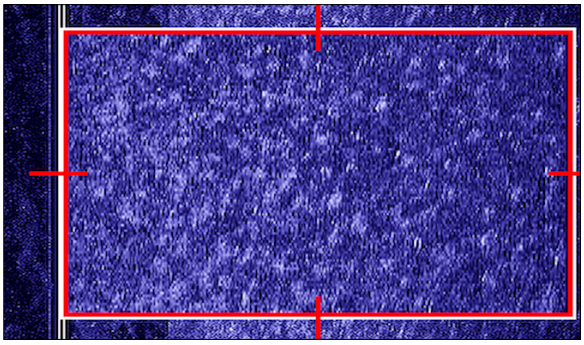
7. Anomaly 20

During the LWS Project, MHM listed Anomaly 20 as 38th in line for investigation out of 46 targets. Re-prioritizatoin placed Anomaly 20 as the 7th in siginficance for the LWNA-

1 Project. Initially MHM estimated that Anomaly 20 was 17 feet long and was a V-shape feature of unknown nature. Upon the re-prioritization of the LWS Project anomalies, MHM deduced number 20 might be the bow of a wreck upon comparison to other, similar anomalies from Lake Minnetonka. The 2013 scan of the lake bottom where Anomaly 20 was recorded in 2012 plainly shows no features or submerged cultural resources.

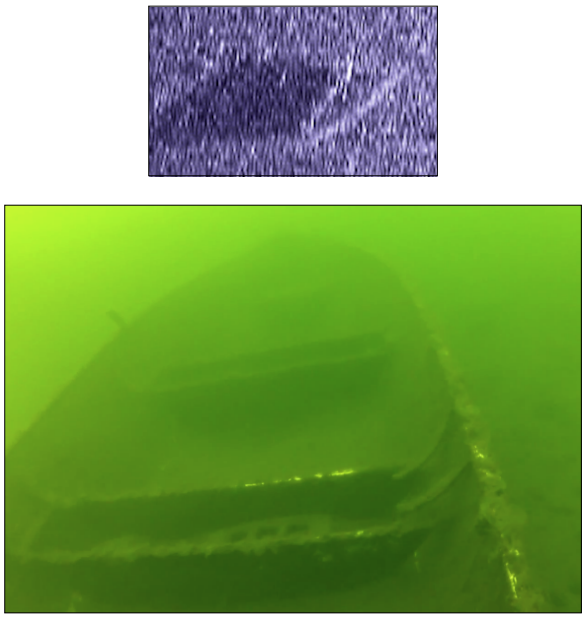


The August 2013 view of Anomaly 20 clearly shows a V-shaped resource.

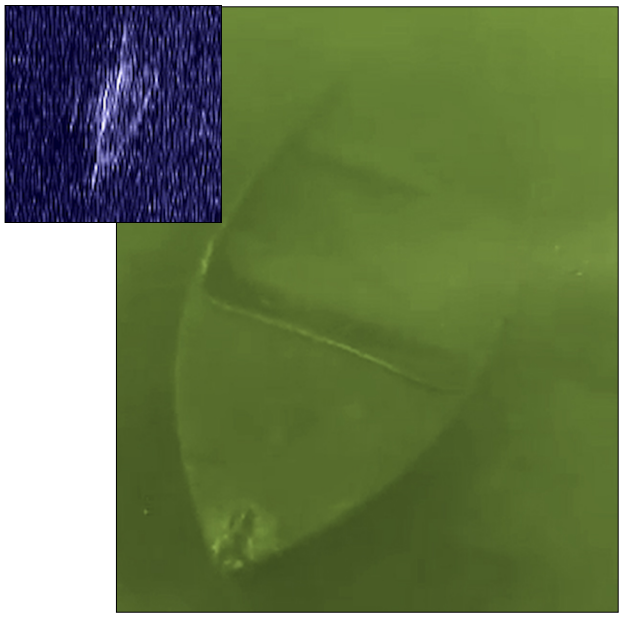


In September 2013 Anomaly 20 was not present.

Two anomalies from Lake Minnetonka that have proven to be wrecks have similar sonar signatures to Anomaly 20. Anomaly 69 (mentioned above) is the 16 foot long Lund Aluminum Fishing Boat Wreck and Anomaly 20.1 is the 12 foot long Aluma Craft Model R Runabout Wreck. Anomaly 69 has a significant acoustical shadow while Anomaly 20.1 has a minor one. By comparison, Lake Waconia's Anomaly 20 has an acoustical shadow between the two Lake Minnetonka anomalies. The Lund Wreck's signature matches three sonar images from Lake Wacoina because multiple recordings were made of Anomaly 69 during the LMS-1 Project from different directions and speeds; both of these factors affect the output of a sonar unit.



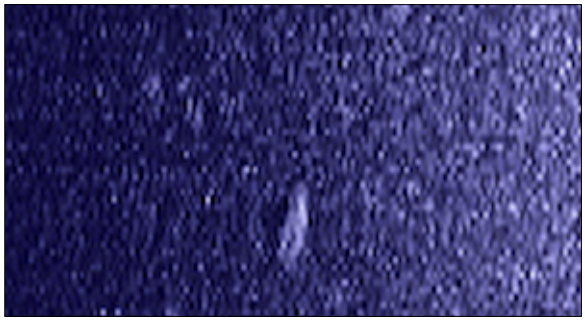
Anomaly 69's second sonar image compares to Anomaly 20; the wreck was purposefully sunk (photograph by MHM volunteer Kelly Nehowig).



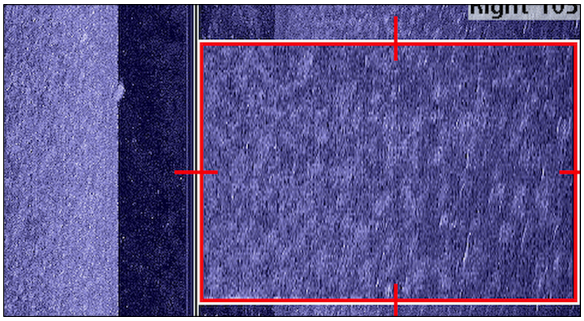
Anomaly 20.1's sonar image compares to Anomaly 20 and is a Lake Minnetonka wreck (photograph by MHM volunteer Ed Nelson).

8. Anomaly 21

MHM originally estimated that Anomaly 21 was 12 feet long and deduced that it may be a small boat wreck, possibly with a cockpit. The 2012 sonar image indicated a feature pointed on one end with a healthy acoustical shadow. MHM prioritized Anomaly 21 as number 11 out of the 46 anomalies recorded during the LWS Project. The recent 2013 sonar image, like the others, clearly shows that no feature is present on the bottom of the lake. Lake Waconia is 21 feet deep in this area. MHM has not investigated an acknowledged submerged cultural resource that is the equivalent of Anomaly 21.



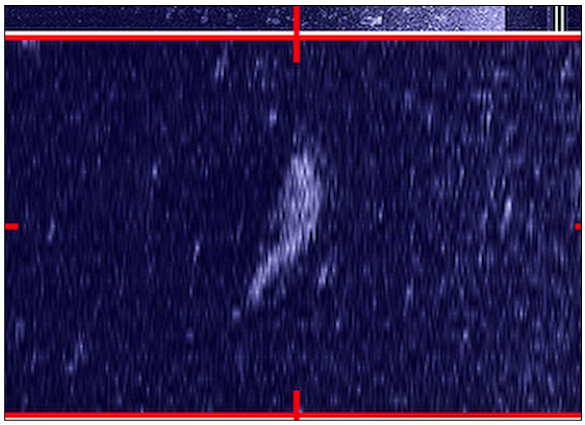
The appearance of Anomaly 21 in August 2012.



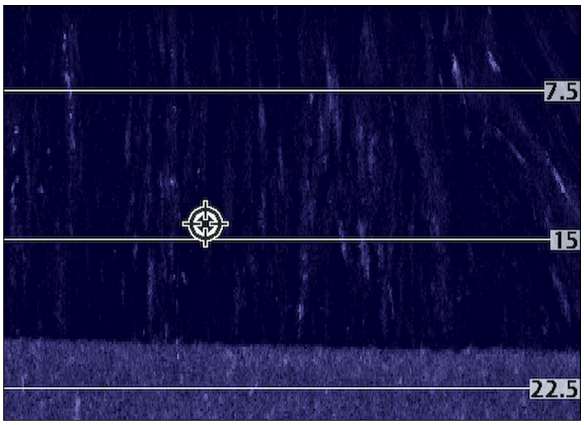
Anomaly 21 does not exist in September 2013.

9. Anomaly 22

From its sonar image, MHM deduced that Anomaly 22 was seven feet long and that it was possibly a small boat wreck. During the LWS Project it was ranked number 35 out of the 46 anomalies in importance because of its lack of a shadow. However, the shape remained suggestive of a submerged watercraft after the confirmation of a wreck with a similar sonar image in Lake Minnetonka. The sonar down image recorded in 2013 clearly indicates there is no target in this area – the sonar's cursor is placed over the exact location where Anomaly 22 should be – and shows the water depth to be 20 feet at this point.

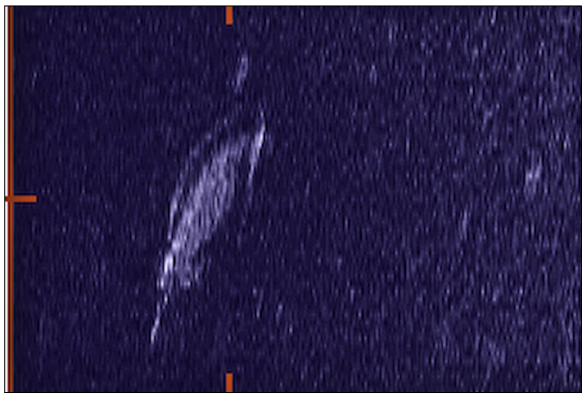


Anomaly 22 was recorded in August 2012.

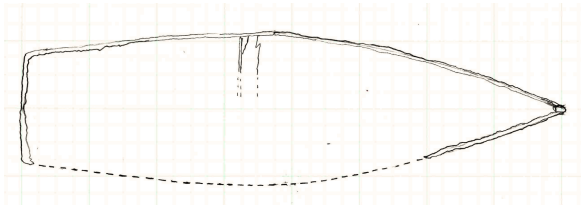


In September 2013 MHM's survey boat passed directly over the spot where Anomaly 22 was recorded the previous year; the cursor is above the location where the anomaly should be.

Although not an exact match, Anomaly 22 is similar to the sonar signature of the Gideon Bay Wreck (21-HE-415), formerly known as Anomaly 63, in Lake Minnetonka. The Gideon Bay Wreck is a wooden rowboat from the early 20th Century. The similarities betwen Anomaly 22 and this wreck allowed MHM to have confidence that the Lake Waconia example would be a cultural resource but unforunately, that supposition was incorrect.



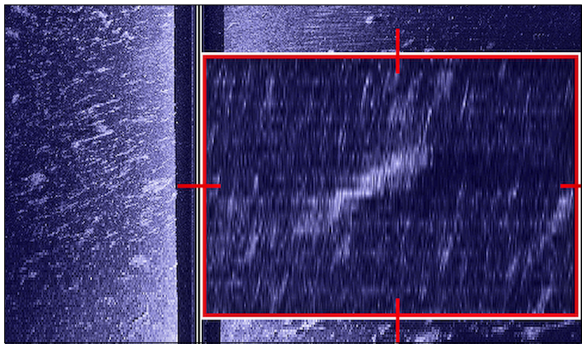
The Gideon Bay Wreck (21-HE-415) in Lake Minnetonka, located in September 2012 and confirmed as a wreck in May 2013, has a similar acousitical signature to Anomaly 22.



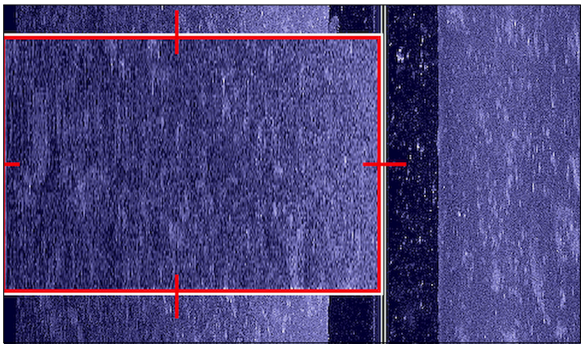
MHM's sketch of the Gideon Bay Wreck, a 16 foot early 20th Century rowboat.

10. Anomaly 25

The somewhat undefined shape of Anomaly 25 suggested to MHM that it may not be a cultural, but a natural, resource. However, this aspect of the object was offset by its significant acoustical shadow. But, the shape did lower the anomaly's signficance to number 30 out of 46 Lake Waconia research priorities. MHM estimated the size of Anomaly 25 to be 14 feet long and surmised it may be s small boat. But, the 2013 sonar footage clearly shows that no resource, cultural or otherwise, exists where Anomaly 25 was recorded in 2012. The water depth where Anomaly 25 should be is 15 feet deep. One anomaly from MHM's other sonar surveys compares to Anomaly 25 and at it has proven to be a submerged cultural resource.

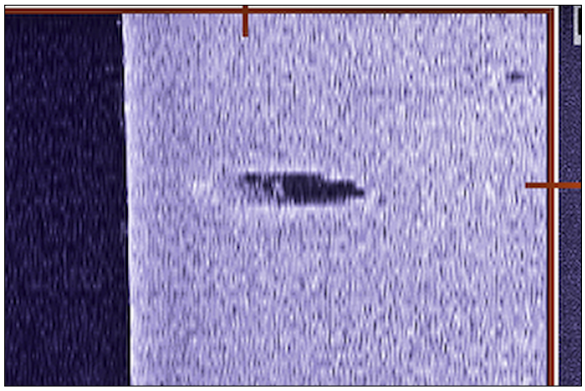


Anomaly 25, recorded in August 2012.

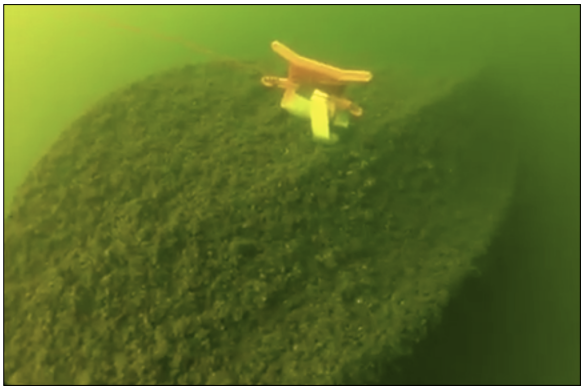


The area where Anomaly 25 should be, recorded in September 2013.

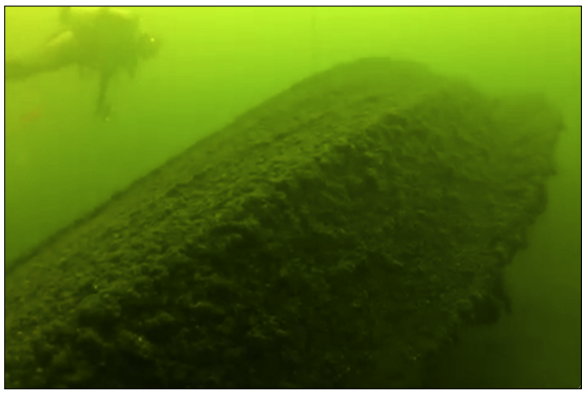
Anomaly 32 in Lake Minnetonka has an undefined shape and a similar acoustical shadow as Anomaly 25. Anomaly 32 was identified in October 2013 as a 1960s Span America or Span Boat. She is capsized and her bow is suspended in the water column.



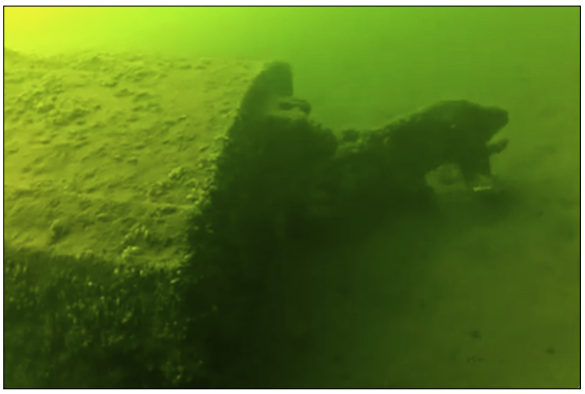
MHM recorded this sonar image of Lake Minnetonka's Anomaly 32. The anomaly's shape is indistinct but the substantial acousitical shadow prompted MHM to make Anomaly 32 a priority.



Anomaly 32 is a capsized fiberglass wreck. The orange and yellow object is part of the diver buoy that is dropped from MHM's boat to mark an anomaly using GPS. Sometimes the buoy weights land on top of the site as in this instance (photograph by MHM volunteer Kelly Nehowig).



The port bow of Anomaly 32 and MHM staff Olson. The bow is supended in the water column (photograph by MHM volunteer Kelly Nehowig).



The wreck's inboard engine's lower unit extends out of the transom (photograph by MHM volunteer Kelly Nehowig).

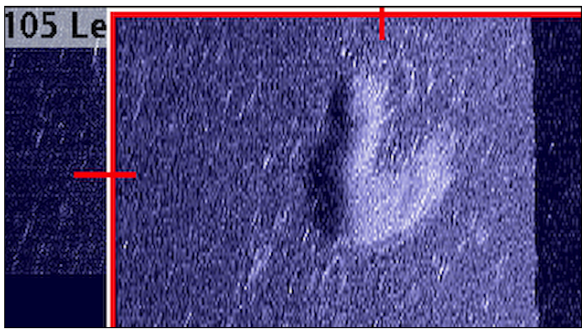
'Appearing Anomalies'

During the 2013 sonar re-scan of Lake Waconia where the 10 targets for the LWNA-1 Project were recorded in 2012, MHM located nine anomalies that were not there in 2012. The 'appearance' of these anomalies is supporting evidence for MHM's conclusion that the 10 anomalies (27, 29, 18-25) investigated by SCUBA during the LWNA-1 Project were not present.

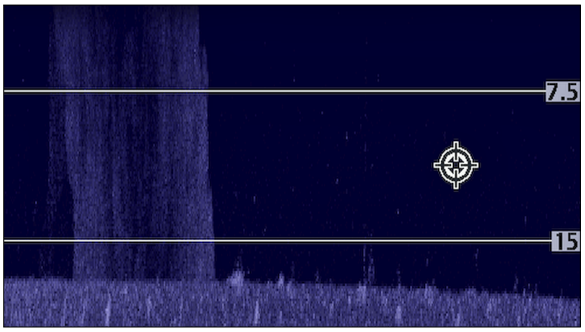
1. Anomaly A

Anomaly A was recorded in late September 2013 and the image on the right, where the curser is located, is the exact location in a down image from August 2012. While MHM

would not have chosen Anomaly A for further scrutiny because of it's shape, it serves to illustrate the changes that occur on the bottom of Lake Waconia. In 2012 MHM's survey boat passed directly over the spot shown and it is obvious that there was no anomaly at this location.



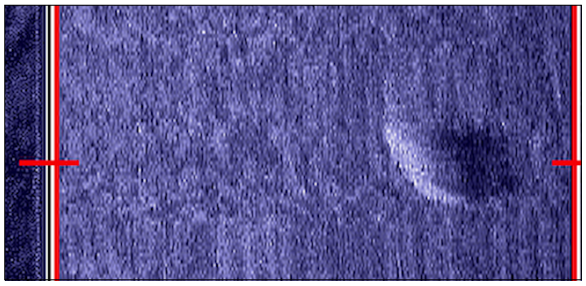
Anomaly A, recorded in September 2013, is an irregularly shaped group of vegetation that has an acoustical shadow.



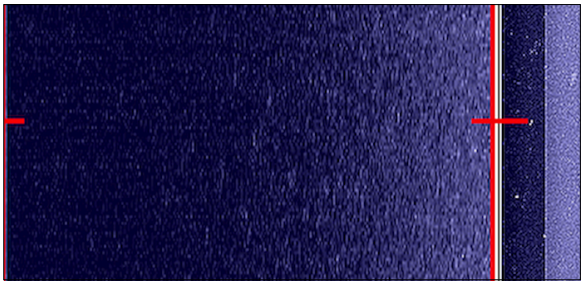
The cursor in the down image recorded in August 2012 is above the location where Anomaly A should be. The milky streak is the remains of a boat wake that disturbed the water column.

2. Anomaly B

As with Anomaly A, the 'appearance' of the boat-shaped Anomaly B is evident where previously, the bottom of the lake was clear.



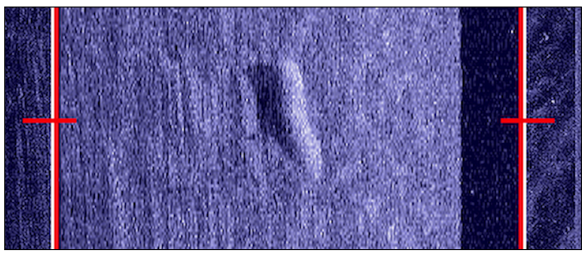
September 2013: MHM would have slated Anomaly A for study if it existed in August 2012.



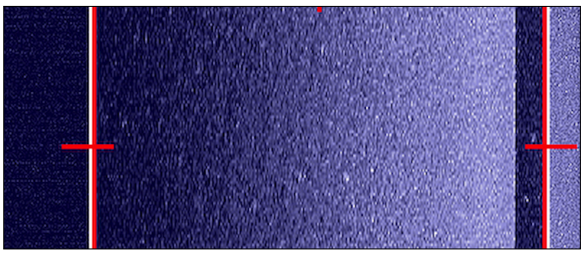
In August 2012 Anomaly A did not exist.

3. Anomaly C

Anomaly C was recorded on the bottom of the lake in late September 2013 but there is no evidence of an object there in August 2012. It is nearly boat-shaped and MHM might have slated it for SCUBA reconnassiance if it were located in 2012.



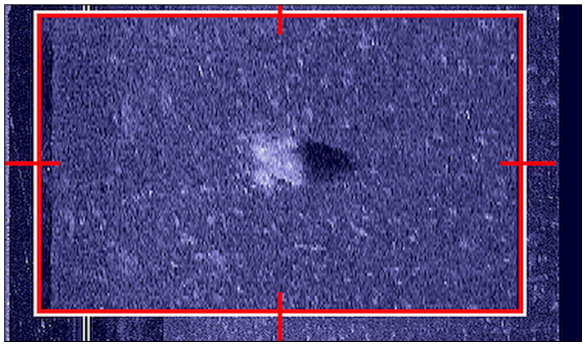
Anomaly C, recorded in September 2013.



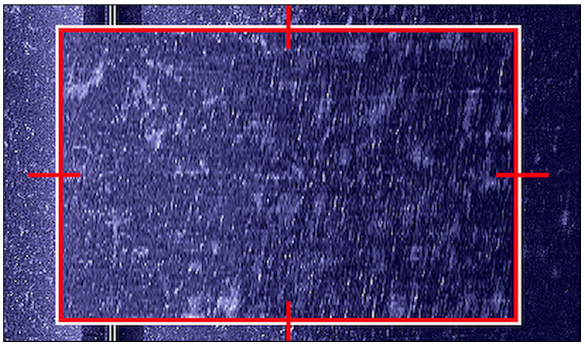
Anomaly C did not exist in August 2012.

4. Anomaly D

Anomaly D, with a significant acoustical shadow, was clearly seen in 2013. MHM would have probably have given it an anomaly number because of its shape and shadow if it had been located in 2012.



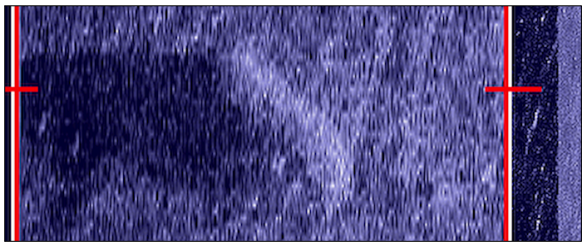
Square-like Anomaly D in September 2013.



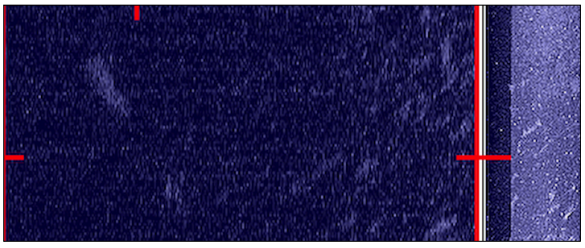
The square did not exist in August 2012.

5. Anomaly E

Anomaly E cast a substantial acoustical shadow in the 2013 image; the 2012 recording does have a somewhat similar shape in the upper left corner of the red box, but it does not have a significant shadow. If it is the same object, it has changed over the last year and is not a cultural resource.



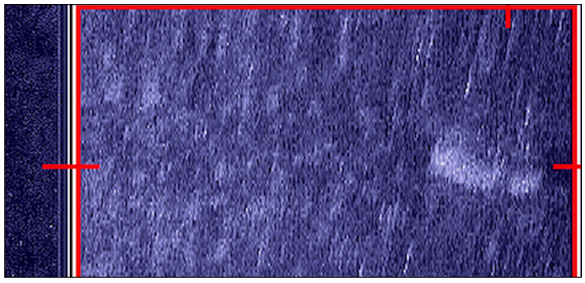
Anomaly E in September 2013.



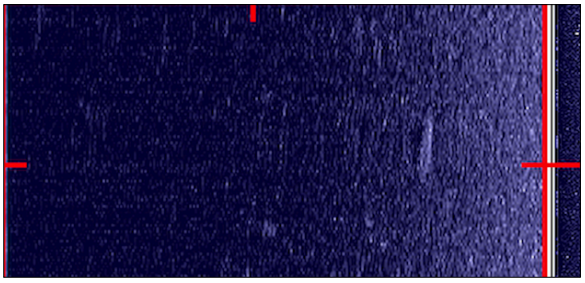
Anomaly E in August 2012? If so, it has changed.

6. Anomaly F

Anomaly F was recorded in 2013 and the same area scanned in 2012 reveals a small anomaly that MHM determined was not a cultural resource. If Anomaly F is the same object seen in the 2012 image, it has changed over the year and confirms that it is not a submerged cultural resource.



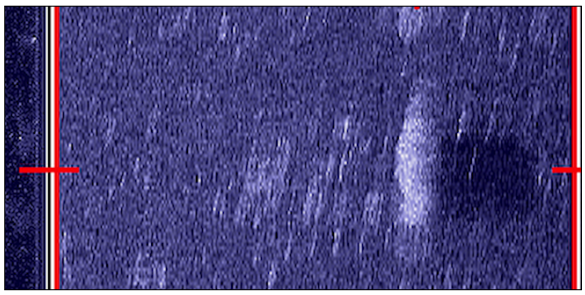
Anomaly F in September 2013.



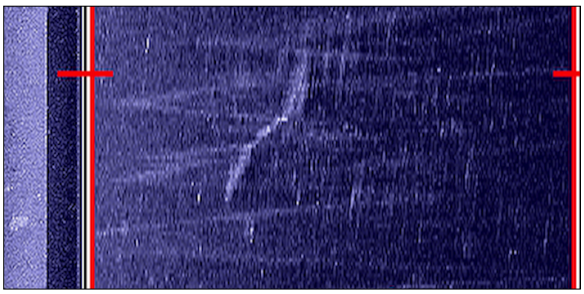
Anomaly F in August 2012? If so, it has changed.

7. Anomaly G

The Anomaly G image from 2013 is much different than the Anomaly G image from 2012. These images may be the same object and if so, its changing nature clearly indicates it is a submgered natural – not cultural – resource.



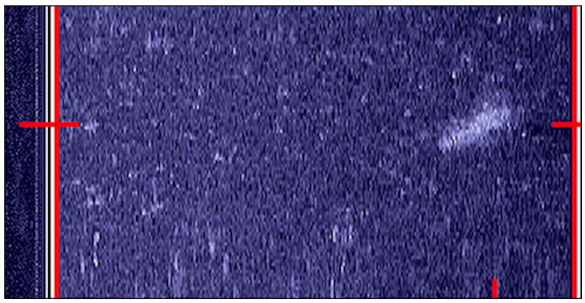
Anomaly G in September 2013.



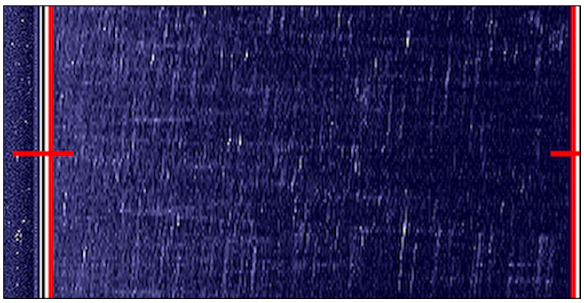
Anomaly G in August 2012? If so, it has changed.

8. Anomaly H

Boat-like H recorded in 2013 resembles Lake Waconia's Anomaly 29 and Anomaly 10 from Lake Minnetonka, both false targets. The sonar image from 2012 confirms that false target status since the Anomaly H did not exist until 2013.



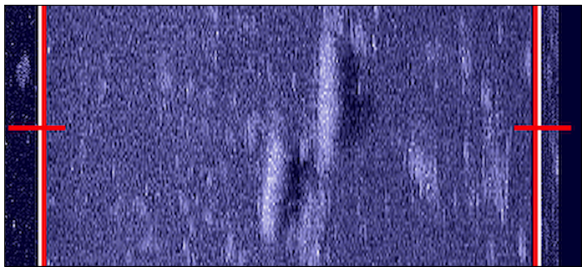
Anomaly H in September 2013.



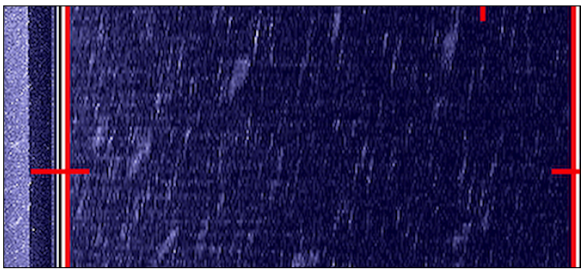
Anomaly H did not exist in August 2012.

9. Anomaly J

Lastly, 2013's Anomaly J is comprised of two objects that do not appear in the same area in 2012. However, there are two small targets in proximity to where Anomaly J is located. One of these anomalies may be Anomaly J, only changed over time, and that would confirm it is a natural resource.



Anomaly J in September 2013.



Anomaly J does not exist in August 2012.

Conclusion

MHM has concluded that the ten anomalies investigated during the LMNA-1 Project consisted of vegetation and lake bottom contours. There are 36 anomalies located during the LWS Project that still require investigation and identification. However, the negative results of the LWNA-1 Project have brought into question the probable significance of most, if not all, of these anomalies – particularly since MHM re-prioritized the 46 Lake Waconia anomalies based on results obtained from diving reconnaissance in Lake Minnetonka. Based on the negative results from Lake Waconia, MHM advocates halting further archaeological reconnaissance diving in the lake for the time being. The shallow nature of Lake Waconia supports an abundance of aquatic plant growth that can imitate submerged cultural resources when recorded by sonar.

Therefore, in order to design smart and efficient underwater reconnaissance projects in the future, MHM proposes to conduct a project at White Bear Lake to determine the nature of prioritized anomalies identified there during the White Bear Lake (WBL) Survey. MHM located three wrecks in White Bear Lake during the survey and an additional 21 anomalies that have not yet been investigated by SCUBA reconnaissance. White Bear Lake is smaller than Lake Waconia, primarily shallow, but with deeper sections like Lake Minnetonka – it is a hybrid of the two lakes. From reports the visibility of White Bear Lake is significantly better than Lake Waconia, suggesting it has a different bottom than the larger lake – hard sand with a layer of silt. By contrast, Lake Minnetonka is a combination of these two – many sections have soft mud bottoms and very poor visibility while others have sandy bottoms with good to exceptional visibility. The nature of a lake's bottom affects the amount and type of aquatic marine and organism growth that can influence the output of a sonar unit. MHM has confirmed over two-dozen wrecks and maritime sites in Lake Minnetonka at this point, in bays with muddy bottoms and in areas with sandy bottoms. MHM has determined that conducting SCUBA reconnaissance on anomalies in White Bear Lake to determine their nature will allow for more accurate comparisons of sonar images that will lead to the continued re-prioritization of anomalies in that lake, Lake Waconia, and Lake Minnetonka. The ultimate goals of anomaly re-prioritization are the identification, documentation, preservation, and conservation of Minnesota's finite nautical and maritime cultural resources – MHM's stated Mission.